

AN
EXPLANATION

FOR

534. 6. 31.
4

Keeping a Ship's Traverse at Sea,

BY THE

COLUMBIAN
READY RECKONER.

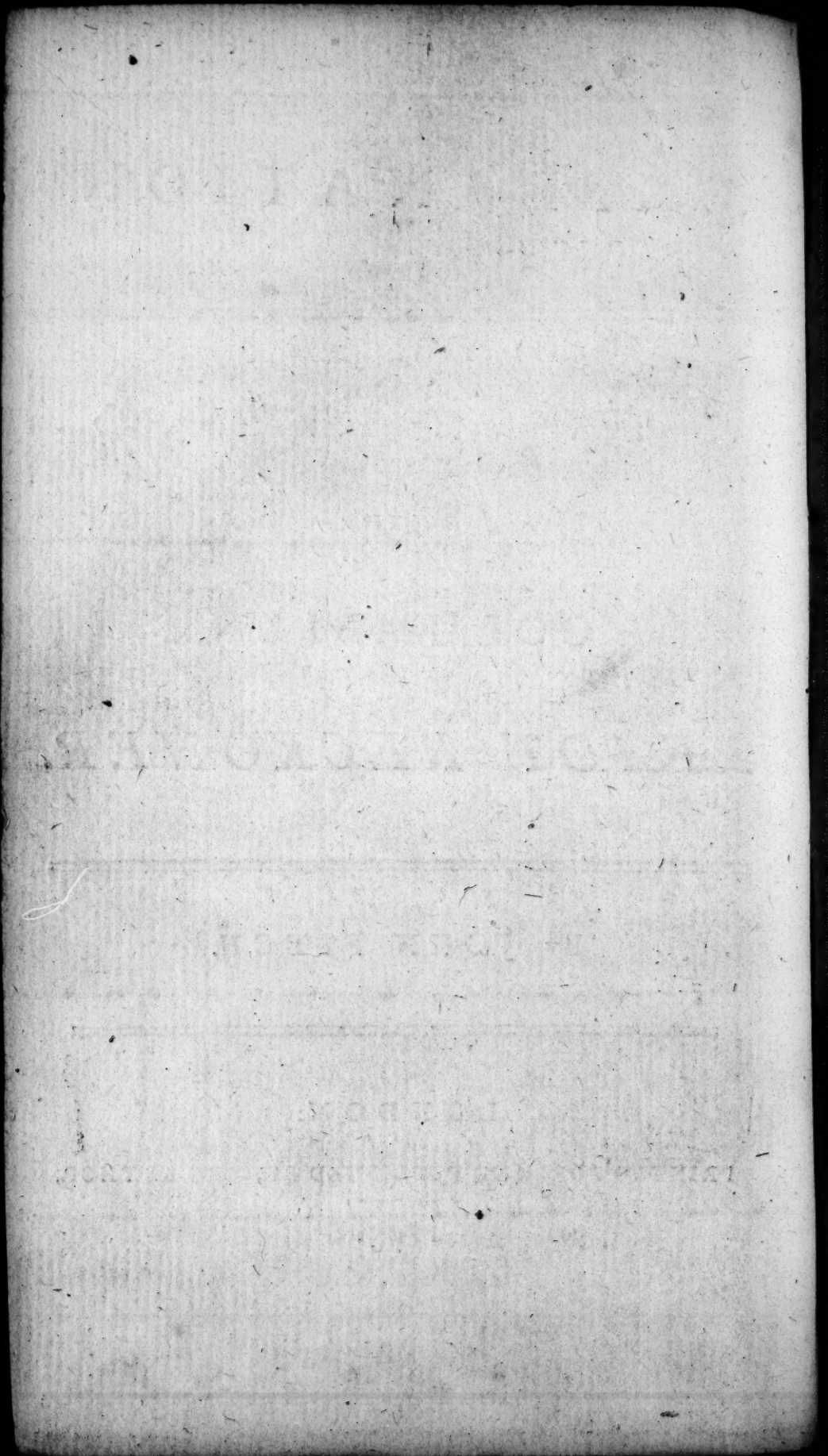
By JOHN FITCH.

LONDON:

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1793.

*The table belonging to this
pamphlet is in Tab. 437. 6. 1*



to

Dr. WILLIAM THORNTON,

Member of the Philosophical Society,

PHILADELPHIA.

WORTHY SIR,

THE humble attempt I have made for keeping a ship's reckoning at sea, which I present to you, and which I propose offering to the public, I dare not dedicate to so exalted a Genius without first obtaining his permission: At the same, time feel myself in honor bound to make an apology for mentioning your name, and give my reasons why one who has ever been confined within the walls of a mechanick's shop, should commit so flagrant an assault upon the learned world, in offering a new publication on that subject.

However, I am persuaded, if you do not approve, you at least will forgive, as my motives are to benefit mankind, and the promotion of useful Art.

Sir, my ideas on the subject, and my reasons for offering them to the public, are as followeth. Altho' I never turned my attention to navigation, no further than to learn the theory, yet in crossing the Atlantick, I saw on board the packet a round board with the points of the compass cut on it, and holes in the points. I further observed, that when they had run one hour, they put a peg into the point they had just run.

This gave me an Idea that something more perfect might be made, in consequence of which I went to work, and formed the enclosed plate, which, as it appears to me, will reduce the art of navigation to the comprehension of the smallest capacity, and simplify it in such a manner, as to save masters of vessels much trouble in their reckonings.

I have in this indeavoured to bring the art of navigation into one focal point, also make it easy to those who look upon calculations as a burthen. I do not think it absolutely necessary that masters of vessels should be obliged to study geometrical propositions, problems, drawing of lines, angles and curves, or to teaze themselves with logarithems, signs, tangents and trigonometry; altho' it would be very convenient for them to know them; but that it is sufficient for them to know these things to be so, also that the lines and angles pointed out by these figures, are more accurate than any drawn with a ruler: I therefore trust that all

questions, necessary for keeping a ship's traverse, can be resolved by this method, and most of them in much less time than in the common way now practised. I presume that this could be learned by a moderate genius, conversant with figures, in six hours teaching, and a very moderate share of common arithmetick will be fully sufficient for this method of navigation: And in case a person has not the use of the pen, he may cross the Atlantick without the necessity of making a figure; nevertheless it is strongly recommended to all masters of vessels to keep a regular journal of their reckonings

The volumes printed on the art of navigation, with their copious tables annexed, appears to the ignorant and unlearned, almost incomprehensible, besides knowing that it takes a considerable length of time, for even the first genius to become masters of the art, and that it likewise is attended with considerable expence and loss of time, which their finances will not admit of; they of course reconcile themselves to wear out their days before the mast, yet, no doubt but amongst this class of men, there are geniuses that might be made more capable of managing a vessel than some masters.

The spirit of emulation is destroyed in this class of men, as they well know that they never can attain to become mate or master of a vessel; they of course do not think of leading circumspect lives, but mix amongst the worst of society, and go to

dissipated places, and spread further dissipation; when on the contrary they might be a good example, and a means of reform, which probably in all nations is eminently wanting.

This plate with a table of the sun's declination will be fully sufficient to carry a vessel round the world, and as it is brought into so small a compass it can soon be learned. However, I do not mean that navigators should proceed no further in the art, this is only designed to assist the unskilled, and ease the burden of professors.

My table of latitude and dept. is so small, that it may be readily covered with the eye at the first look, therefore not subject to the tediousness of turning leaf after leaf, and tracing the columns from top to bottom, and side to side; but where you find the distance in my table, you also find the lat. & dept, and there is no danger of looking into a wrong column, and taking out a wrong figure; yet as small as my table is, the calculations can never vary from the truth, more than five in a thousand. And it being compendious, makes it easy to revise, and every figure to be relied upon, whilst in copious tables it is almost impossible but there should be some errors committed, either by the author or printer.

I also conceive that this method will be of great utility to masters of vessels, for when it becomes a burden to them to bring up the ship's reckoning by common calculations with pen,

ink, and paper, this will to the contrary be an amusement.

By this means the ship's reckoning would never be liable to be left behind, more than a day, of course the navigator will at all times be ready to speak a vessel.

I do not mean to make any observations on navigation, but only to explain my own work, yet I cannot help saying that I should be well pleased to see masters of vessels graduate their log lines to tenths of knots, for it is quite as easy to put down three, four or six tenths, as five; and I think we ought always to make use of the greatest degree of accuracy possible, when it can be done with the same degree of ease.

It has been observed to me by some masters of vessels, that it would not be attended with good consequences to make every man that followeth the sea a navigator, as it would be a means of destroying the subordination so very necessary to be kept on board.

To which I beg leave to observe, that in my opinion, it would have a very different effect, for the following reasons.

1st. Men of no ambition, are never to be feared in any plot or mutiny, without ambitious leaders.

2nd. Men of an ambitious turn, who may have a prospect of an honorable command, undoubtedly would be cautious of setting such an

example, which would have a tendency to destroy their views to advancement, but if after a good conduct, they should attain what they were aiming at, that would become a president at a future day to those under their command.

However, in this case I appeal not only to seamen, but to the army, to know if there are any amongst them, who are more subordinate, and on the wing to obey, than those who are striving for promotion.

But after all, it is not impossible but I may be too sanguine in this my new method of navigation; yet I flatter myself, as I am tolerably well acquainted with the thoery of that art, as it is now taught in America, that there is no question really necessary in navigating a ship, but may be answered by my card or plate, besides the ease and simplicity of the calculations, I think will make it truly desirable to the greatest professors.

I have shewn my plate to many masters of vessels, and there has been no defects pointed out by any, but all allow that it will answer the purpose I have intended it for.

I am also of opinion, that an apprentice to the sea would learn the art of navigation in one voyage to America, provided the card is placed on board where free access can be had to it, and the officer of the watch be punctual in setting down the ship's way.

Notwithstanding, it is not improbable, but it may be disapproved by many ; some perhaps through selfish motives, and others from an honest heart, who cannot go suddenly into the merits of it ; therefore wish those to answer the following questions.

1st. Will it not answer the purpose for a seaman, with the help of a quadrant, to navigate a vessel round the world ?

2nd. Cannot it be acquired by an apprentice in one voyage to America ?

3rd. Is it not as ready a method of working as any known, and as perfect as calculations by trigonometry ?

If they are constrained to answer these in the affirmative, my reasons, I hope, will justify my publication, and trust they may sufficiently plead for an apology with you. After which I shall feel myself happy in meriting your esteem, and subscribing myself

your most sincere friend,

and humble servant,

JOHN FITCH.

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FOR
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THIS is a plate, which may be composed of metal, paper, skins, wood, or any other substance, and by having it graduated similar to the following description.

The first table thereon is to keep the ship's course, with the distance for points, half points and quarter points, the same to be pierced with four holes in each column, to keep the distance the ship runs on each point.

The 2nd. is a table of lat. and dept. whose figures may be called decimals, units, tens, hundreds or thousands, by calling the figures which give the lat. and dept. in the same proportion as they are called.

The figures standing on the lines, with the points, half points, &c. are for the distance run. The figures standing in the squares above and below these figures, are to ascertain the lat. and dept. of that dist. upon that point.

For example, suppose a ship should sail N. E. b N. 7m. this is three points E. of N. therefore in the square above 7 in the three point course is found 5, 82, and in the square below 3, 89; this shews that the lat. is 5m. 82 hundredths N. and 3m. 89 hundredths E. from the place the ship set out. Now had the course been 70m. the first decimal must be made a whole number, this would make the northing 58m. 2 tenths, and the eastings 38m. 9 tenths, but when it comes to 700m. both the decimals must be taken as whole numbers, and the ship will be 582m. N. and 389m. E. of the place she sailed from. In the same manner all the rest of the figures are to be worked.

The third table is to keep the ship's reckoning of her lat. & dept. & is divided into four columns, the heads of which are marked N. S. E. W. these columns are pierced with four holes each, in several rows, every fourth hole being marked of a decimal.

The fourth table is to shew how many miles answer to a degree of longitude at every degree of latitude

The 5th is a table of tangents, graduated to every point, half point, and quarter point, of the compass, that when the lat. and dept. is known which the ship has to make, this points out the course she has to steer. It is also pierced with one hundred holes to contain that number of pins, marked from one to nine, and ten blanks or cyphers: these pins are to keep the ship's reckoning. There will also be found in these tables plenty of spare holes to work any sum by the said pins in common arithmetick.

It must always be noticed by young learners that northings and southings are different of lat. and eastings and westings are different of longitude. It must also be remembered that every degree of latitude contains sixty geographical miles, and the degrees of longitude are continually varying, they being 60 miles at the equator and diminish as they advance towards the poles, and in the poles terminate in a point. But they diminish in a much greater ratio as they advance towards the poles than near the equator, as the fourth table shews.

For example suppose a ship sails south 1200. I demand her difference of lat. the 1200 must be divided by 60, because there are 60m. to every degree of lat. the answer is 20 degrees of south latitude.

Suppose a ship sails E. 1200m. in the lat. of 30 degrees, I demand the difference of longitude.

It may be found in the fourth table that at 30° . of lat. a degree of longitude is 51m. 96 hundredths of a mile; of course the 1200 must be divided by 51,96, and by adding two cyphers to the 1200, these decimals viz. 96, will be reckoned as whole numbers; this makes 1200. 120,000, this divided by 5196 gives 23 degrees, and a fraction left of 492; and to bring this into tenths, there must be another cypher added, which makes the fraction 4920; out of which you cannot have 5196, of course there must be a cypher set down in the quotient, as the first decimal, and another cypher added to the 4920, which makes 49200 out of which you will have 5196 nine times, and a fraction remaining, which may be neglected; then the answer will stand 23° . 09, or that he has made 23 degrees and nearly one tenth of E. longitude.

Suppose a ship sails W. 1200m. in the lat. of 60° degrees, I demand the difference of longitude. It is found by the table that a degree of longitude in the lat. of 60° . is 30m. this 30 are whole numbers, of course there is no cyphers to be added to the 1200, but simply divide it by 30 and the answer will stand 40° . of W. longitude.

Being thus provided with these tables, and having a small plate, graduated similar to the first described table, put in a box and screwed down on the Binocle with 50 pins to keep the seaman's account, and for him to mark down the distance

as he runs it, and in this situation the ship puts to sea.

Let us suppose that the ship sets out from Surinam, which we say may be in the lat. of 6° N. and $50^{\circ} 44'$ W. longitude, and bound for La-Rochelle, on the coast of France, supposed in $46^{\circ} 10'$ N lat. and $1^{\circ} 14'$ W. longitude. The master then subtracts the 6° of N. lat. of Surinam from the $46^{\circ} 10'$ of La-Rochelle, and finds that he has $40^{\circ} 10'$ of N. Lat. to make, or 2410 m. He then subtracts the $1^{\circ} 14'$ of W. longitude of La-Rochelle, from the $56^{\circ} 44'$ of Surinam, and finds that he has $55^{\circ} 30'$ of E. longitude to make; he then multiplies (55 and a half or) 55,5 by the number of miles, in a degree of longitude, at the lat. of 6 degrees, he finds by the table, that each degree upon that lat. is 59m. 67 hundredths, of course multiplies 55,5 by 59, 67, and finds upon that degree of Lat. he must make nearly 3312m. to come to the meridian of La-Rochelle, he then multiplies 55,5 the number of degrees he has to cross, by the number of miles contained in them in the Latitude of La-Rochelle, and finds by the Table, that at the lat. of 46° there is 41 m. 68 hundredths, which multiplied by 55,5 gives him 2313m. castings, from the meridian he is in to the meridian of La-Rochelle, the remaining fraction he will not notice. He then adds his castings in the lat. of Surinam and his castings in the lat. of La-Rochelle

together, and takes the half for his main eastings. He finds that of 6° . to be 3312, and that of 46° . to be 2313, these added together makes 5625, the half of which is 2812m. for his main eastings; of course he knows that he has 2410m. of northings, to make, and 2812 of eastings, to reach his port.

The right angled lines in the table of tangents, may be reckoned for any number of miles, that may be most convenient, such as tens, fiftys, hundreds, or hundreds of leagues; in this case he finds that he has 800 leagues of northings to make, and 900 and one third of eastings, therefore he goes from the bottom up to the eighth line marked 8 and for his eastings, one third across the 9th line marked 9, from the left, and traces that distance down till it intersects the line 8, this gives him his course nearly N. E. half E. and shapes his course, viz. N. E. half E. The first hour he runs 6m. 2 tenths; either the man at the helm, or the Officer of the watch, takes a pin marked 2, and puts it down in a decimal point, in the column under N, and the next under 4 pts. he then takes one marked 6, and puts it down in the same column, in the first hole of whole numbers.

The next hour he runs 7m. 3 tenths, he then returns the decimal, and puts in its place one marked 5; he also returns back the 6, and puts in its place one marked 3, and to the left, of it

sets one marked 1, which makes 13m. 5 tenths. The 3d hour he runs 8m. 6 tenths, he then returns the 5 from the decimal, and puts in its place one marked 1, and carries one to the whole Nos. and then returns the 13, and puts in their place two marked 2 each, which makes 22m. 1 tenth he has run that course, which he continues for 560m. and then by contrary winds, is obliged to lay his course E 2 points S. or E. S. E. 80m. he then is drove by a storm, W. 1 point S. or W. by S. 155m; then N. 3 points, W. 70m. he then wants to know the lat. and dept. the ship has made, and her course to the port destination.

He finds his first course to be N. 4¹/₂ points E. or rather E 3¹/₂ points N. 560m. this being nearer the E. than the N. his departure must be greater than his lat. in that case he looks to the right hand side of the table, to direct him for his lat. and dept. of that course and distance, and on the line of 3¹/₂ points at 5, in the square above he finds marked 3, 86, but as he reckons that 5 for 500 he makes the decimals whole numbers, and finds that 500m. of that course he has made 386m. of eastings, above the 6 is 4, 64 and as he calls that 6 sixty, he adds one decimal to the whole number, this shews him that 60m. that course makes 46m. 4 tenths of departure; these added together makes 432m. 4 tenths of eastings he has made, which he sets down in the table of the ship's reckoning, in the column under E. He

then for his lat. looks in the square under 5, and finds it marked 3,17, and as he calls that 5 500 it is 317m. northings; he also finds in the same manner that 60m. is 38m. 1 tenth, these added together makes 355m. 1 tenth of northings, made that course; accordingly he sets in the table of the ship's reckoning in the column under N. 355, 1

The second course he finds to be E. 2 points S. 80m. he looks in the two point course, and above 8 he finds 7, 39, which shews his dept. to be 73m. 9 tenths, and sets it down under E. as before, and under 8 he finds 3,06, which gives him his southings 30m. 6 tenths, which he puts down in the column marked S.

The 3d course is W. 1 point, S. 155m. For the hundred it would always be more proper to look to the 10, than to the 1, as that is carried one figure further in the calculation as 1 is 0, 98, and 10 is 9, 81, if it is taken from the one, it gives 98, if from 10, 98, 1, in the same manner he finds that 50 gives 49 of westings, and 5 gives 4m. 9 tenths, by adding these together, he finds that he has made 152m. of westings on that course, and sets it down in the column marked W. He also finds for his lat. under the same figures for 100 19, 5, and for 50, 9. 8 and for 5m. 98 hundredths, which he may call one mile, when added together, makes 30m. 3 tenths, which he puts down in the column under S.

The fourth course being N. 3 points W. 70m. he looks on the 3 point course, above 7 he finds marked 5, 82, and it being nearer the N. than the W. he is directed to find his lat. from the left of the table, and puts down in the column under N. 58, 2, for his lat. and for his departure 38,9 in the column marked W. and when he adds these up, he finds in this voyage that he has made 413m. 3 tenths of northings, 60m. 9 tenths of southings 506m. 3 of eastings and 190m. 9 tenths of westings.

He then substracts his southings, from his northings, and finds himself to be 352m. 4 tenths N. from the place he set out, he also substracts his westings from his eastings, and finds himself 315m. 4 tenths east.

Then in order to shape his course for the desired port, he substracts his northings from his first northings, and his eastings from his main eastings, and finds that he has 2047 m. further to go N. and 2497 m. E. before he reaches his port, and if he reckons 100 leagues to a line in the table of Tangents, he will have about 8 lines and one third to go from the left, and six lines and five-sixths from the bottom, which place will point out to him his course, which will be found to be nearly the same he first set out upon.

He ought also in his voyages to take some notice in what latitudes he makes his principal

Eastings or Westings, and make allowances as near as may be agreeably to the table.

Suppose a vessel in a part of the Bay of Biscay, that should be 200m. N. and 150m. E. of the southernmost Cape, and it should sail S. 3 pts. W. 90m. then W 3 pts. S. 90m. I demand the course the Cape bears from the vessel, and the distance to the Cape.

It is found by the table of Lat. and Dept. that the vessel has made in these two courses 124m. 8 tenths southings, and the same westings, which subtracted from the southings and westings, it is found that the vessel has to make 75m. 2 tenths of southings, and 25, 2 westings. Then if the lines in the table of Tangents are reckoned for 10m. each, they must be reckoned from the bottom 7¹/₂ lines, and from the left 2¹/₂ lines, and the intersection of these distances gives the course nearly S. 1¹/₂ pts. W.

Now had they intersected immediately upon a point, half point, or quarter point, there would be no other difficulty in finding the distance with accuracy than to have traced that point along in the table of lat. and dept. till the lat. or dept. should be found the same as is wanting to be made. In this case, we find that 80m. that course would give 76m. 6 tenths of lat. which is too much, and the departure too small, occasioned by the true course straying off from the course of the ship. But I expect that this will be accurate enough for most sailing masters; if not, it is

recommended to them to ascertain it by the square root, agreeable to the following example.

Take the sum of the squares of the lat. and dept. and add them together and extract the root, it will give the distance as thus :

The Lat. is 75,2
Multiplied by 75,2

1504
3760
5264

is 5655,04
Dept. added 635,04

62'90"08 | 79,31

49
149 | 1390
1341

1583 | 4908
4749

15861 | 15900
15861

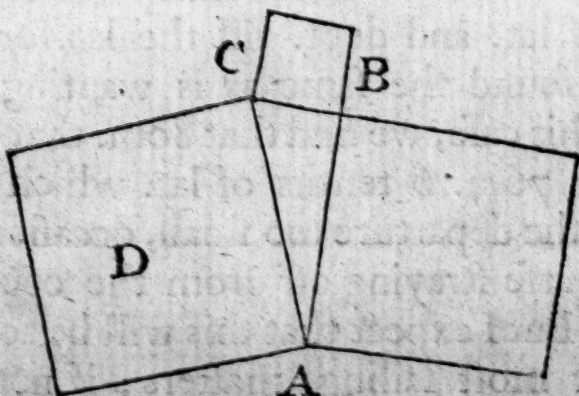
39

The Dept. is 25,2
Multiplied by 25,2

504
1260
504

635,04

This gives the distance 79m.
and 31 hundredths.



The reasons why the sum of the squares of the lat. and dept. when the root is extracted gives the distance, is illucidated in the above example.

In all right angled triangles, the sum of the squares of the two legs is equal to the square of the hypothynuse, as in this case the southings is 75,2, the westings 25,2 as in the triangle, A, B, C, and by multiplying the legs into themselves it gives their own squares, and adding them together gives the same as the square of the hypothynuse, then by extracting the root it gives one side of the square D, which makes the hypothynuse of the triangle.

This is with the greatest deference submitted to the publick, and should it be found useful, and answer the purpose for which the Author designed it, and approved by professors in that line, his most sanguine wishes will be fully gratified.

F I N I S.



